

### **REMARKS**

This amendment is being filed in response to the non-final Office Action mailed February 15, 2011 (“the Action”). Reconsideration of the application is respectfully requested. Claims 1-16 were previously cancelled. Claims 17-39 are pending and stand rejected. Amendments have been made to the claims to correct typographical errors; no new matter is added by these amendments.

Reconsideration of the claims in view of the foregoing amendments and the following remarks is respectfully requested.

### **Examiner Interview**

An interview was conducted between Examiner Hoang and representative Ryan C. Fox on April 12, 2011. During the interview, the Examiner and Mr. Fox discussed the references and the language of the independent claims. In particular, the inapplicability of the Munshi reference to the claim language was discussed. Arguments discussed in the Interview are detailed below.

The Examiner is thanked for granting the interview.

### **Claim Rejections Under 35 U.S.C. § 103(a)**

Claims 17-21, 24-29, and 32-36 were rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over U.S. Patent No. 5,933,146 to Wrigley (hereinafter “Wrigley”) in view of U.S. Patent App. Pub. No. 2003/0001842 to Munshi (hereinafter “Munshi”). However, for at least the reasons discussed below, Wrigley and Munshi, taken either separately or in combination, fail to teach or suggest each and every recitation of the claims. The Action therefore failed to make a *prima facie* case of obviousness of claims 17-21, 24-29, and 32-36 and the rejections are improper.

Claims 17, 24, and 32 are independent.

*Claims 17-21*

Independent claim 17, as amended, recites, in part:

storing, by the computing device, the object of intersection in a list of objects that have been intersected by the ray; and  
after the object of intersection is stored in the list:  
searching the list, by the computer device, for the object of intersection, and  
preventing, by the computing device, further performing of intersection computations between the object of intersection and the ray after performing the first intersection computation.

In the rejection of claim 17, the Action acknowledged that these recitations are not taught by Wrigley. [See, Action, at § 4.] However, the Action allegedly found relevant disclosure in Munshi. The Action's characterization of Munshi is respectfully traversed.

The rejection argued that Munshi teaches the above-quoted recitations of claim 17 at Figure 4 and at paragraph 0030. Figure 4 of Munshi illustrates an "object descriptor" which points to objects which are consulted during ray tracing to determine how a ray should react upon intersecting an object:

Thus, when a reflected ray is spawned from the point of intersection on an object, for example, the ray tracer will determine whether any objects are stored in reflections list 404 for the intersected object (e.g. if the number/length of the list is nonzero as specified in object descriptor 402 ), and if so, it will ignore any intersections of the spawned reflected ray with objects listed in list 404 (or ignore intersections for all but the listed objects if list 404 specifies an "include" rule).

[Munshi, at paragraph 0027.] It is noted with particularity that in Munshi, after an intersection with an object, "the ray tracer will determine whether any objects are stored in reflections list 404 for the intersected object." A person of ordinary skill in the art, in accordance with the plain meaning of the language, would understand the language to mean the objects which are stored in Munshi's "reflections list 404" are stored there because they are associated with an intersected object, not because they themselves are intersected objects. Munshi therefore does not teach or suggest "*storing . . . the object of intersection* in a list of objects that have been intersected by the ray" as recited in claim 17.

Furthermore, at paragraph 0030, Munshi describes when and how objects are placed in Munshi's list:

*As shown in FIG. 5, the rules received from the modeling system are parsed and are used to populate the include/exclude lists such as those illustrated in FIG. 4 (S 502). For each ray of a scene or frame to be rendered (determined in step S 504), therefore, the list of object visibility rules for the object or light source from which the ray is projecting is retrieved (S 506). Regardless of the type of ray that is being projected from the point of intersection with the object (e.g. reflected, refracted, shadow, etc.), the ray tracer begins to trace the ray from a point of intersection or light source (S 508). The nearest object struck by the ray is then compared to the list of rules specified for the originating object or light source and the ray type (S 510). If the struck object is specified in the list, and is associated with an "include" rule, or if the object is not specified in the list, normal ray-object intersection processing with the object will be performed (S 512) . . .*

[Munshi, at paragraph 0030.] As the cited passage shows, Munshi's list is populated with object references based on "rules received from the modeling system." After the objects are placed in the list, rays are traced. Then, after a ray intersects an object, Munshi's list is compared to see if the just-intersected object was previously placed in the list prior to the intersection.

In contrast, claim 17 recites "storing . . . the object of intersection in a list of objects that have been intersected by the ray." However, because Munshi stores its objects before ray tracing can begin, it cannot teach or suggest "storing . . . the object of intersection in a list of objects that have been intersected by the ray," since it is not clear before tracing which objects will or will not be intersected by a ray. Similarly, because Munshi's objects are stored before intersections are computed, Munshi's pre-loaded list cannot teach or suggest "*searching the list . . . for the object of intersection*;" and preventing . . . further performing of intersection computations between the object of intersection and the ray *after performing the first intersection computation*" as recited in claim 17. No further relevant disclosure or teaching is found in Munshi.

For at least these reasons, Munshi does not teach or suggest the above-quoted language of claim 17. Therefore, neither Wrigley nor Munshi, individually or in combination, teach or suggest each and every recitation of claim 17. The rejection of

independent claim 17 therefore failed to make a *prima facie* case of obviousness under 35 U.S.C. § 103(a). Claim 17, as well as claims 18-21, which depend from independent claim 17, should be allowable over the cited references. It is respectfully requested that the rejection of claims 17-21 under 35 U.S.C. § 102(e) be withdrawn and that the claims be allowed.

#### *Claims 24-29*

Independent claim 24 recites, in part:

a ray-casting module operatively configured to traverse rays through the acceleration structure and return ray-object intersection data, the ray-casting module comprising a decision unit operatively configured such that, when ray-object intersection data has been computed for a given ray and a given object, the decision unit records that the given ray has intersected the given object and prevents additional ray-object intersection computations from being carried out for the given ray and the given object.

The Action rejected claim 24 over the same passages of Munshi as in the rejection of claim 17. [See, Action, at § 9, pages 5 and 6.] Therefore, for at least the reasons discussed above with respect to claim 17, neither Wrigley nor Munshi, individually or in combination, teach or suggest each and every recitation of claim 24. The rejection of independent claim 24 therefore failed to make a *prima facie* case of obviousness under 35 U.S.C. § 103(a). Claim 24, as well as claims 25-29, which depend from independent claim 24, should be allowable over the cited references. It is respectfully requested that the rejection of claims 24-29 under 35 U.S.C. § 102(e) be withdrawn and that the claims be allowed.

#### *Claims 32-36*

Independent claim 32 recites, in part:

for a given ray, and for an object for which an intersection computation has been performed with the given ray:  
record that the intersection computation has been performed for the given ray and the object; and

prevent further performing of intersection computations between the object and the given ray.

The Action rejected claim 32 over the same passages of Munshi as in the rejection of claim 17. [See, Action, at § 15, page 8.] Therefore, for at least the reasons discussed above with respect to claim 17, neither Wrigley nor Munshi, individually or in combination, teach or suggest each and every recitation of claim 32. The rejection of independent claim 32 therefore failed to make a *prima facie* case of obviousness under 35 U.S.C. § 103(a). Claim 32, as well as claims 33-36, which depend from independent claim 32, should be allowable over the cited references. It is respectfully requested that the rejection of claims 32-36 under 35 U.S.C. § 102(e) be withdrawn and that the claims be allowed.

#### *Claims 22, 23, 37, and 38*

Claims 22, 23, 37, and 38 were rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Wrigley in view of Munshi and further in view of U.S. Patent No. 6,597,359 to Lathrop (hereinafter “Lathrop”). Claims 22, 23, 37 and 38 depend from independent claims 17 and 32, respectively. For at least the reasons discussed above, Wrigley and Munshi, taken either separately or in combination, fail to teach or suggest each and every recitation of claims 17 and 32. Further, relevant disclosure is not found in Lathrop to address the deficiency of the rejection. It is therefore submitted that claims 22, 23, 37, and 38 are allowable over the cited references. It is respectfully requested that the rejection of claims 22, 23, 37, and 38 under 35 U.S.C. § 103(a) be withdrawn and that claims 22, 23, 37, and 38 be allowed.

#### *Claim 30*

Claim 30 was rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Wrigley in view of Munshi and further in view of U.S. Patent App. Pub. No. 2004/0233222 to Lee et al. (hereinafter “Lee”). Claim 30 depends from independent claim 24. For at least the reasons discussed above, Wrigley and Munshi, taken either separately or in combination, fail to teach or suggest each and every recitation of claim

24. Further, relevant disclosure is not found in Lee to address the deficiency of the rejection. It is therefore submitted that claim 30 is allowable over the cited references. It is respectfully requested that the rejection of claim 30 under 35 U.S.C. § 103(a) be withdrawn and that claim 30 be allowed.

*Claims 31 and 39*

Claims 31 and 39 were rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Wrigley in view of Munshi, further in view of Lee, and further in view of Lathrop.

Claim 31 depends from independent claim 24. For at least the reasons discussed above, Wrigley and Munshi, taken either separately or in combination, fail to teach or suggest each and every recitation of claim 24. Further, relevant disclosure is not found in Lee or Lathrop to address the deficiency of the rejection. It is therefore submitted that claim 31 is allowable over the cited references. It is respectfully requested that the rejection of claim 31 under 35 U.S.C. § 103(a) be withdrawn and that claim 31 be allowed.

Claim 39 is independent. Claim 39 recites, in part:

a list unit, the list unit being coupled to a plurality of list caches for storing lists of object addresses for objects that have already been intersected by a ray, the list caches arranged in an n-level hierarchy, the list unit having a decision unit, the decision unit configured to prevent objects whose object addresses are stored in the list from being intersected again by the ray . . . .

In the rejection, the Action acknowledges that the above-quoted language from claim 39 is not taught by Wrigley, but finds relevant disclosure in the same passages of Munshi as discussed above. [See, Action, at § 29, page 18.] For at least the reasons discussed above, Wrigley and Munshi, taken either separately or in combination, fail to teach or suggest these recitations of claim 39. Further, relevant disclosure is not found in Lee or Lathrop to address the deficiency of the rejection. It is therefore submitted that claim 39 is allowable over the cited references. It is respectfully requested that the rejection of claim 39 under 35 U.S.C. § 103(a) be withdrawn and that claim 39 be allowed.

### CONCLUSION

In view of the foregoing amendments and remarks, it is believed the applicable rejections have been overcome and all claims remaining in the application are presently in condition for allowance. Accordingly, favorable consideration and a Notice of Allowance are earnestly solicited. The Examiner is invited to telephone the undersigned representative at (503) 796-2446 if the Examiner believes that an interview might be useful for any reason.

It is not believed that extensions of time are required beyond those that may otherwise be provided for in documents accompanying this paper. However, if additional extensions of time are necessary to prevent abandonment of this application, then such extensions of time are hereby petitioned under 37 CFR 1.136(a). If any fees are due in connection with filing this paper, the Commissioner is authorized to charge the Deposit Account of Schwabe, Williamson and Wyatt, P.C., No. 50-0393.

Respectfully submitted,  
SCHWABE, WILLIAMSON & WYATT, P.C.

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